NGM COLLEGE (AUTONOMOUS)
PG & RESERACH DEPARTMENT OF MATHEMATICS
M.Sc. Mathematics Programme

SCHEME OF EXAMINATIONS (2016-17 onwards)

Subject Code	Subjects	Ins Hrs/week	Examinations				Credits
			Dur. Hrs	CIA	ESE	Total	
	SEMESTER I						
16PMS101	Core I: Algebra	6	3	25	75	100	4
16PMS102	Core II: Real Analysis	6	3	25	75	100	4
16PMS103	Core III: Complex Analysis	6	3	25	75	100	4
16PMS104	Core IV: Ordinary Differential Equations	6	3	25	75	100	4
16PMS1E1	ME I : Matlab	4	3	25	75	100/2=50	3
16PMS1E2	ME Practical II : Programming Lab in Matlab	2	3	40	60	100/2=50	2
TOTAL		**30**	**-**	**130**	**370**	**500**	**21**
SEMESTER II							
16PMS205	Core V: Linear Algebra	6	3	25	75	100	4
16PMS206	Core VI: Mathematical Statistics	6	3	25	75	100	4
16PMS207	Core VII: Partial Differential Equations	5	3	25	75	100	4
16PMS208	Core VIII: Mechanics	6	3	25	75	100	4
16PMS209	Core IX: Numerical Methods	4	3	25	75	100/2=50	3
16PMS210	Core Practical X: Programming lab in Numerical Methods using Matlab	2	3	40	60	100/2=50	2
16PMS2N1/ 16PMS2N2	NME -Mathematical Statistics and Techniques/ Mathematics in Finance	1	3	---	100	100	2
TOTAL		**30**		**130**	**470**	**600**	**23**

SEMESTER III							
16PMS311	Core XI: Topology	6	3	25	75	100	4
16PMS312	Core XII: Functional Analysis	6	3	25	75	100	4
16PMS313	Core XIII: Combinatorics	6	3	25	75	100	4
16PMS314	Core XIV: Graph Theory	6	3	25	75	100	4
16PMS3E3	ME III: Latex	4	3	25	75	100/2=50	3
16PMS3E4	ME Practical IV: Programming Lab in Latex	2	3	40	60	100/2=50	2
TOTAL		**30**		**130**	**370**	**500**	**21**
SEMESTER IV							
16PMS415	Core XV: Fluid Dynamics	6	3	25	75	100	4
16PMS416	Core XVI: Operator Theory	6	3	25	75	100	4
16PMS417	Core XVII: Control Theory	6	3	25	75	100	4
16PMS4E5	ME V: Stochastic Differential Equations	6	3	25	75	100	5
16PMS4P1	Core XVIII: Project	4+ 2(Lab)	----	40	160	200	8
TOTAL		**30**	**----**	**140**	**460**	**600**	**25**
GRAND TOTAL		**120**		**530**	**1670**	**2200**	**90**

ME-Major Elective NME- Non Major Elective

List of Electives:

1. Magneto Hydro Dynamics
2. Stochastic Differential Equations
3. Algebraic Number Theory
4. Algebraic Topology
5. Fuzzy Logic and Fuzzy Sets
6. MATLAB (Theory & Practical)
7. Latex (Theory & Practical)
8. Differential Geometry
9. Cryptography
10. Distribution Theory.

List of Non Major Electives

1. Mathematical Statistics & Techniques
2. Mathematics in Finance

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS101 **Title : ALGEBRA**		
Hrs/ Week	6	**Credits : 4**
Objectives	To enable the students to learn several advanced concepts in algebra which have wider applications in higher analysis, topology, theory of numbers, geometry, physics and chemistry etc. This paper is designed in such a way that a student can realize the importance of the topics like Sylow's theorems, polynomial rings, extension of fields and Galois theory.	

Unit	**Contents**	**Hrs**
Unit-I	Sylow's Theorem and Inner Product Spaces.	16 hours
Unit-II	Polynomial Rings, Polynomials over the Rational field and Polynomial Rings over Commutative Rings.	16 hours
Unit-III	Extension Fields and Finite Fields.	15 hours
Unit-IV	Roots of Polynomials and More about roots.	16 hours
Unit-V	The Elements of Galois theory.	15 hours

Text Book	Herstein I.N. (2010), *Topics in Algebra*, 2nd Edition, Wiley India Pvt. Ltd., New Delhi.
Reference Books	1. John B. Fraleigh (2003), *A First Course in Abstract Algebra*, Narosa Publishing House, New Delhi. 2. Surjeet Singh, Qazi Zameeruddin(2006), *Modern Algebra*, Vikas Publishing House Pvt. Ltd., Delhi. 3. Bhattaracharya P.B, Jain K, and Nagpaul S.R (2009), *Basic Abstract Algebra*, Cambridge University Press, New York.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS102 **Title : REAL ANALYSIS**		
Hrs/ Week	6	**Credits :** 4
Objectives	The aim of this syllabus is to aid learners in attaining a broad understanding of analysis techniques that are the basic stepping-stones to contemporary research. It is assumed that learners are familiar with the subject matter of the undergraduate analysis courses. This syllabus enables the learners to learn and understand in depth sequence and series of functions, functions of several variables and differential forms. Also study Lebesgue integral and Lebesgue measure.	

Unit	**Contents**	**Hrs**
Unit-I	**Riemann-Stieltjes Integral:** Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of Vector-valued Functions – Rectifiable Curves.	15 hours
Unit-II	**Sequences And Series Of Functions:** Uniform convergence – Uniform Convergence and Continuity – Uniform Convergence and Integration – Uniform Convergence and Differentiation – Equicontinuous Families of Functions – The Stone-Weierstrass Theorem.	16 hours
Unit-III	**Functions of Several Variables:** Linear Transformations – The Contraction Principle –The Inverse Function Theorem – The Implicit Function Theorem – Determinants – Derivatives of Higher Order.	16 hours
Unit-IV	**Lebesgue Measure:** Lebesgue Outer Measure – The σ-Algebra of Lebesgue Measurable sets– Lebesgue Measurable Functions.	15 hours
Unit-V	**Lebesgue Integral:** The Lebesgue integral of bounded Measurable function over a set of finite measure – The Lebesgue Integral of a Measurable nonnegative function –The general Lebesgue integral.	16 hours
Text Book	1. Walter Rudin, (2013), *Principles of Mathematical Analysis*, McGraw Hill. New York. For units I-III: Chapters 6, 7, 9.	

	For Unit 1: Chapter 6. Unit 2: Chapter 7. Unit 3: Chapter 9 Except Differentiation , The Rank Theorem &– Differentiation on Integrals. 2. Royden H.L. and Fitzpatrick P.M. (2010), *Real Analysis*, Fourth Edition, Pearson Education, Inc., Publishing as Prentice Hall. For Unit 4: Sections 2.1,2.2,2.3, 3.1,3.2. Unit 5: Sections 4.1,4.2,4.3,4.4.
Reference Book	1. R.G.Bartle,(1976), *Elements of Real Analysis*,2nd Edition, John Wiley and Sons, New York. 2. W.Ruddin,(1986), *Real and Complex Analysis*,3rd Edition, McGraw-Hill, New York.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS103 **Title : COMPLEX ANALYSIS**		
Hrs/ Week	6	**Credits :** 4
Objectives	This paper provides a transition from undergraduate elementary results to postgraduate advanced topics and enables the learners 1) to understand and to evaluate the definite integrals in an easy and effective way using calculus of residues. 2) to get a deeper understanding in the advanced topics such as harmonic functions, Infinite products and Normal families. Also it motivates the learners to take up research in the field of Complex Analysis.	

Unit	Contents	Hrs
Unit-I	**The General form of Cauchy's Theorem:** Chains and Cycles – Simple Connectivity – Homology – The General Statement of Cauchy's Theorem – Proof of Cauchy's Theorem – Locally Exact Differentials – Multiply Connected Regions.	16 hours
Unit-II	**The Calculus of Residues and Harmonic Functions**: The Residue Theorem – The Argument Principle – Evaluation of Definite integrals – Definition and Basic Properties of Harmonic Functions – The Mean Value Property.	15 hours
Unit-III	**Series and Product Developments:** Poisson's Formula – Schwarz's Theorem – The Reflection Principle – Weierstrass's Theorem – The Taylor Series – The Laurent Series.	15 hours
Unit-IV	**Partial Fractions and Factorization and Entire Functions:** Partial Fractions – Infinite Products – Canonical Products – The Gamma Function, Zensen's Formula.	16 hours
Unit-V	**Normal Families and Elliptic Functions:** Equi-continuity – Normality and Compactness, Arzela's Theorem – Families of Analytic Functions – Simply Periodic Functions - Representation by Exponentials – The	16 hours

	Fourier Development – Doubly Periodic Functions – The Period Module – Unimodular Transformations .	
Text Book	Lars V. Ahlfors (2013), Complex *Analysis*, McGraw-Hill International Edition, Third Edition (Indian Edition).	
Reference Books	1. Serge Lang (2005), *Complex Analysis*, Springer International Edition. 2. Shanti Narayan & Dr.P.K.Mittal, (2014), Theory *of Functions of a Complex Variable*, S.Chand & Company Pvt. Ltd. 3. Herb Silvermann (1975), *Complex Analysis*, Houghton Mifflin Company.	

CONTENTS:

UNIT I : Chapter 4: Sections 4.1 – 4.7
UNIT II : Chapter 4: Sections 5.1, 5.2, 5.3, 6.1and 6.2.
UNIT III : Chapter 4: Sections 6.3, 6.4, 6.5.
Chapter 5: Sections 1.1, 1.2, 1.3.
UNIT IV : Chapter 5: Sections 2.1, 2.2, 2.3, 2.4.
Chapter 5: Sections 3.1.
UNIT V : Chapter 5: Sections 5.1, 5.2, 5.3, 5.4.
Chapter 7: Sections 1.1, 1.2.
Chapter 7: Sections 2.1, 2.2.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS104 **Title : ORDINARY DIFFERENTIAL EQUATIONS**		
Hrs/ Week	6	**Credits :** 4
Objectives	Differential equations play an important role in science, engineering and social sciences. Many phenomena in these branches of knowledge are interpreted in terms of differential equations and their applications. This paper helps the students to i. learn linear equations and systems, ii. study the existence and uniqueness of solutions of initial value problems, iii. find solution by various methods, iv. understand the results of oscillation and boundary value problems.	

Unit	**Contents**	**Hrs**
Unit-I	Linear differential equations of higher order	16 hours
Unit-II	Solutions in power series (Except 3.1)	15 hours
Unit-III	Systems of Linear Differential Equations (Except 4.1)	15 hours
Unit-IV	Existence and uniqueness of solutions; and Oscillations of second order equations (Except 5.5 to 5.8 & 6.6)	16 hours
Unit-V	Boundary Value problems (Except 7.4)	16 hours

Text Book	Deo S. G. and Raghavendran . V (1990),*Ordinary Differential Equations and stability Theory*, Tata McGraw Hill Publishing company Limited.
Reference Book	1. Martin H.(1985), *Ordinary Differential Equations*, Tata McGraw Hill Publishing company Limited. 2. Coddington E. A and Levinson N.,(1955),*Theory of Ordinary Differential Equations*, McGraw Hill, New York.

Department	Mathematics	
Course	M. Sc	**Effective From the Year :**2016
Subject code : 16PMS1E1 **Title : MAT LAB**		
Hrs/ Week	4	**Credits : 3**
Objectives	To make students to learn the software in a friendly and non- intimidating fashion and helps them to solve the numerous sample problems in Mathematical sciences as a new users of MATLAB.	
Unit	**Contents**	**Hrs**
Unit-I	Starting with MATLAB – Creating arrays- Mathematical operations with arrays.	11 hours
Unit-II	Scripts files- Functions and function files.	11 hours
Unit-III	Two-dimensional plots- Three- dimensional plots.	10 hours
Unit-IV	Programming in MATLAB.	10 hours
Unit-V	Polynomial - Curve fitting and interpolation.	10 hours
Text Book	Amos Gilat (2004), *MATLAB An Introduction with Application*, John Wiley & Sons, Singapore.	
Reference Books	1. Prata R. P (2006), *Getting Started with MATLAB – A Quick Introduction for Scientist and Engineers*, Oxford University Press, New Delhi. 2. W.J.Palm (2005), *Introduction to MATLAB 7 for Engineers*, McGraw-Hill Education, New York. 3. D.M.Etter, D.C.Kuncicky and H.Moore (2004), *Introduction to MATLAB 7*, Prentice Hall, New Jersy.	

Contents:

Unit-1: Chapter 1, Chapter 2, Chapter 3.
Unit-2: Chapter 4, Chapter 6.
Unit-3: Chapter 5, Chapter 9.
Unit-4: chapter 7
Unit-5: Chapter 8

Department	**Mathematics**	
Course	**M.Sc.,**	**Effective From the Year :** 2016
Subject code : 16PMS1E2 **Title : PROGRAMMING LAB IN MATLAB**		
Hrs/ Week	**2**	**Credit : 2**
Objectives		

List of Programs

1. Program to solve geometry and trigrometry problem.
2. Program to illustrate the row vector operations in a given matrix.
3. Program to illustrate the column vector operations in a given matrix.
4. Program to illustrate the creation of submatrix form a given matrix.
5. Program for friction experiment.
6. Program to analyze the electrical resistive network.
7. Program to calculate distance of projectile by, element by element calculation.
8. Program to create vertical bar, horizontal bar, stairs, stem plots of a function.
9. Program to formatting a plot using commands.
10. Program to create plot of a function using the given data and fplot function.
11. Program to create mesh and surface plots for a given function.
12. Program to create various views of 3D plots.
13. Program for creating a matrix.
14. Program to plot a function and curve corresponds to the interpolation method.
15. Program to calculate value and finding roots of a polynomial.
16. Program to determine a function that best fits the given data.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS205 **Title : LINEAR ALGEBRA**		
Hrs/ Week	6	**Credits : 4**
Objectives	The aim of the syllabus is • To provide the students with a good understanding the concepts and methods described in the syllabus. • To help students develop the ability to solve problems using linear Algebra. • To connect Linear Algebra to other fields both within and without Mathematics. • To develop abstract and critical reasoning by studying logical proofs and the axiomatic method as applied in the Linear Algebra.	
Unit	**Contents**	**Hrs**
Unit-I	**Elementary Canonical Forms:** Characteristic Values - Annihilating Polynomials, Invariant Subspaces.	16 hours
Unit-II	Direct Sum Decompositions - Invariant Direct Sums - The Primary Decomposition Theorem.	16 hours
Unit-III	**The Rational and Jordan Forms:** Cyclic Subspaces and Annihilators - Cyclic Decompositions and the Rational Form	15 hours
Unit-IV	The Jordan Form - Computations of Invariant Factors	15 hours
Unit-V	**Bilinear Forms:** Bilinear Forms - Symmetric Bilinear Forms	16 hours
Text Book	Kenneth Hoffman and Ray Kunge (2013), *Linear Algebra*. Second Edition. PHI learning Private Ltd., New Delhi.	

Reference Books	1. Herstein I. N. (2010). *Topics in Algebra.* Wiley India pvt. Ltd., New Delhi. 2. Kumaresan S. (2001). *Linear Algebra.* Prentice-Hall of India. 3. Serge Lang. (2005). *Introduction to linear algebra*. Springer.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS206 **Title : MATHEMATICAL STATISTICS**		
Hrs/ Week	6	**Credits :** 4
Objectives	The objective of this syllabus is to give a systematic introduction to modern probability theory and Mathematical Statistics. Students mastering the material in this syllabus will be able to read research reports and to do research in this field. It will help the students to face SLET, NET, and CSIR examinations.	
Unit	**Contents**	**Hrs**
Unit-I	**Random events:** Preliminary remarks-Random events and operations performed on them-The system of axioms of the theory of probability-Conditional probability-Bayes theorem-Independent events. **Random variables:** The concept of a random variable-The distribution function-Random variables of the discrete type and the continuous type-Functions of random variables-Multidimensional random variables-Marginal distributions-Conditional distributions-Independent random variables. **Parameters of the distribution of a random variable:** Expected values-Moments-The Chebyshev inequality-absolute moments.	15 hours
Unit-II	**Characteristic functions:** Properties of characteristic functions-The characteristic function and moments-Semi invariants-The characteristic function of the sum of independent random variables-Determination of the distribution function by the characteristic function-The characteristic function of multidimensional random vectors-Probability generating functions. **Some probability distributions:** One point and two point distributions-The Bernoulli scheme. The Binomial distribution-The Poisson distribution.	16 hours
Unit-III	**Some probability distributions:** The uniform distribution-The normal distribution-The gamma distribution-The beta distribution-The Cauchy and Laplace distributions. **Limit theorems:** Preliminary remarks-Stochastic convergence-Bernoulli's law of large numbers-The Levy-Cramer theorem-The De Moivre - Laplace theorem.	15 hours

Unit-IV	**Sample moments and their functions:** The notion of a sample-The notion of a Statistic-the distribution of the arithmetic mean of independent normally distributed random variables-The χ^2 distribution-The distribution of the statistics(X's)-Student's t-distribution-Fisher's Z-distribution. **Significance tests:** The concept of statistical test-Parametric tests for small samples-Parametric tests for large samples.	16 hours
Unit-V	**The theory of estimation:** Preliminary notions-Consistent estimates-Unbiased estimates-The sufficiency of an estimate-The efficiency of an estimate-Method of finding estimates-Confidence intervals.	16 hours
Text Book	Marek Fisz,(1980), *Probability theory and Mathematical Statistics*, Third Edition, John Wiley & sons, Inc.	
Reference Books	1. Gupta S. C. Kapoor V. K. (2000), *Fundamentals of Mathematical Statistics a Modern Approach*, 10th Edition, Sultan Chand & Sons. 2. Irwin Miller, Marylees Miller (2011), *Mathematical Statistics*, 7th Edition, Pearson Prentice Hall Pvt Ltd.	

Contents:

UNIT-I: Chapter 1: Sections 1.1, 1.2, 1.3, 1.5, 1.6, 1.7.
Chapter 2: Sections 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8.
Chapter 3: Sections 3.1, 3.2, 3.3, 3.4.
UNIT-II: Chapter 4: Sections 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7.
Chapter 5: Sections 5.1, 5.2, 5.5.
UNIT-III: Chapter 5: Sections 5.6, 5.7, 5.8, 5.9, 5.10.
Chapter 6: Sections 6.1, 6.2, 6.3, 6.6, 6.7.
UNIT-IV: Chapter 9: Sections 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7.
Chapter 12: Sections 12.1, 12.2, 12.3.
UNIT-V: Chapter13: Sections13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7, 13.8.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS207 **Title : PARTIAL DIFFERENTIAL EQUATIONS**		
Hrs/ Week	5	**Credits : 4**
Objectives	On completion of the course the students are expected to have i. Obtained solid introduction to nonlinear and linear partial differential equations. ii. Understood Charpit's method, Jacobi method, method of seperation of variables, method of integral transforms. iii. a good understanding of Laplace equation, wave equation, diffusion equations and a good knowledge of their various applications in mathematics and other fields.	

Unit	**Contents**	**Hrs**
Unit-I	Non-linear partial differential equations of the first order - Compatible systems of first order equations - Charpit's Method - Special types of first order equations and Jacobi's Method.	15 hours
Unit-II	Linear partial differential equations with **c**onstant co-efficient and Equations with variable coefficients.	16 hours
Unit-III	Method of separation of variables and the method of integral transforms.	15 hours
Unit-IV	Elementary solutions of Laplace's equations - Families of equi-potential surfaces - Boundary value problems - Separation of variables and Problems with axial symmetry.	16 hours
Unit-V	Elementary solutions of one dimensional wave equation - Vibrating membranes: Application of calculus of variations - Elementary solutions of diffusion equation and Separation of variables.	16 hours
Text Book	Ian N. Sneddon, (2006) *Elements of Partial Differential Equations. Dover Publication*, New york.	

Reference Books	1. Michael Renardy and Robert C. Rogers. (2004), *An Introduction to Partial Differential Equations.* Second Edition. Springer. 2. Robert C. Mc Owen. (2004), *Partial Differential Equations, Methods and Applications.* Second Edition. Pearson Education, Inc.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS208 **Title : MECHANICS**		
Hrs/ Week	6	**Credits : 4**
Objectives	On completion of the course the students are expected to have i. Studied and understood Lagrange's, Hamilton's equations and various simple but important results related to them. ii. obtained a sound knowledge in Hamilton-Jacobi theory iii. grasped the basics of relativity	

Unit	Contents	Hrs
Unit-I	**Introductory concepts:** Mechanical system – Generalized Coordinates – Constraints – Virtual Work – Energy and Momentum.	16 hours
Unit-II	**Lagrange's equations:** Derivations of Lagrange's Equations – Examples – Integrals of Motion.	15 hours
Unit-III	**Hamilton's equations:** Hamilton's Principle – Hamilton's Equations.	16 hours
Unit-IV	**Hamilton – jacobi theory:** Hamilton's Principle function – Hamilton-Jacobi Equation.	15 hours
Unit-V	**Canonical transformations:** Differential forms and Generating Functions – Lagrange and Poisson Brackets.	16 hours

Text Book	Donald T. Greenwood, (2014) Cl*assical Dynamics, Dover Publication.*. New York.
Reference Books	1. Goldstein, H.(1950), *Classical Mechanics*. Addison Wesley Press, Inc. 2. Synge, J.L. and Griffith, B.A.(1959), *Principles of Mechanics*. Third Edition. McGraw-Hill company.

Contents:

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS209 **Title : NUMERICAL METHODS**		
Hrs/ Week	4	**Credits : 3**
Objectives		

Unit	**Contents**	**Hrs**
Unit-I	**Solving Nonlinear Equations:** Linear Interpolation Methods – Newton's method – Muller's Method – Newton's Method for Polynomials (excluding Horner's Methods, Parallel Processing) – Bairstow's method for quadratic factors.	11 hours
Unit-II	**Numerical Differentiation And Integration:** Derivatives from differences tables – Higher-order derivatives – Divided difference, Central difference formulas – The trapezoidal rule-A composite formula – Romberg integration – Simpson's rules.	11 hours
Unit-III	**Solving Set Of Equations :** The elimination method – Gauss Elimination and Gauss Jordan methods – LU decomposition method – Matrix inversion by Gauss-Jordan method – Methods of iteration – Jacobi and Gauss Seidal iteration – Relaxation method – Systems of nonlinear equations.	10 hours
Unit-IV	**Solution Of Ordinary Differential Equations :** Taylor series method – Euler and modified Euler methods – Runge-Kutta methods – Multistep methods – Milne's method – Adams-Moulton method.	10 hours
Unit-V	**Boundary Value Problems And Characteristic Value Problems:** The shooting method – Solution through a set of equations – Derivative boundary conditions – Characteristic-value problems – Eigen values of a matrix by iteration – The power method	10 hours
Text Book	Gerald C.F. and Wheatley P.O. (1998), *Applied Numerical Analysis*, Sixth Edition, Addison- Wesley, Reading.	

Contents:

Unit I: Chapter 1: Sections: 1.3, 1.4, 1.5, 1.7, 1.8, 1.11,
Unit II: Chapter 5: Sections: 5.2, 5.3, 5.6, and 5.7.
Unit III: Chapter 2: Sections: 2.3 - 2.5, 2.7, 2.10 - 2.12.
Unit IV: Chapter 6: Sections: 6.2 - 6.7.
Unit V: Chapter 7: Sections: 7.2 – 7.5.

Department	**Mathematics**	
Course	**M.Sc.,**	**Effective From the Year :** 2016
Subject code : 16PMS210 **Title : PROGRAMMING LAB IN NUMERICAL METHOD USING MATLAB**		
Hrs/ Week	**2**	**Credit : 2**
Objectives		

List of Programs

1. Newton Raphson Method to find the roots
2. Matrix inverse by Gauss Jordan Method
3. Eigen values and eigen vectors by Power Method
4. Gauss elimination Method for solving a system of linear equations
5. Gauss Jocabi's Method for solving a system of linear equations
6. Gauss Seidal Method for solving a system of linear equations
7. Numerical integration by Trapezoidal rule
8. Numerical integration by Simpon's 1\3 rule
9. Euler's Method for solving first order ODE
10. Second order Runge Kutta Method for solving first order ODE
11. Fourth order Runge Kutta Method for solving first order ODE
12. Milne's Predictor-Corrector Method for solving first order ODE

Department	Mathematics	
Course	M. Sc.,	**Effective From the Year :** 2016
Subject code : 16PMS2N1 **Title : NME - MATHEMATICAL STATISTICS AND TECNIQUES**		
Hrs / Week : 1		Credits: 2
Unit	**Contents**	**Hrs**
Unit-I	Mean- Median- Standard deviation-Coefficient of variation	3 hours
Unit-II	Correlation Analysis: Simple and Rank Correlation	2 hours
Unit-III	Regression Analysis: Simple Linear Regression	2 hours
Unit-IV	Testing Of Hypothesis: Z Test – t Test	3 hours
Unit-V	Testing Of Hypothesis: Chi square Test – F Test	3 hours
Text Books	Gupta S. P. (2006) Statistical *Methods,* Sultan chand & sons, New Delhi.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code :16PMS2N2 **Title : MATHEMATICS IN FINANCE**		
Hrs/ Week	**1**	**Credits : 2**
Unit	**Contents**	**Hrs**
	Financial Statement Analysis Ratio Analysis Meaning and objectives of financial statement analysis Ratio analysis Types of ratios Liquidity ratios Leverage / Capital structure ratios *Profitability ratios Profitability ratios related to sales Profitability ratios related to investments Return on investments(ROI) Activity ratios Importance of ratio analysis	13 hours
Text Book	Khan M.Y and Jain P.K (1990), *Financial Management* Tata McGraw-Hill Publishing Company Ltd, New Delhi.	
Reference Books	1. Aswath Damodaran (2007), *Corporate Finance*, Theory and Practice, John Wiley and Sons, Inc. 2. Prasanna Chandra (1998), *Managing Investment*,Tata McGraw- Hill Publishing Company Ltd, New Delhi.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS311 **Title : TOPOLOGY**		
Hrs/ Week	6	**Credits :** 4
Objectives	Topology is one of the basic disciplines of pure mathematics and concerns more on logical precision. Its ideas and methods have transformed large parts of geometry and analysis almost beyond recognition. It has also greatly stimulated the growth of abstract algebra. The course content of this paper serves to lay foundation for further study in analysis, geometric and algebraic topology.	
Unit	**Contents**	**Hrs**
Unit-I	Topological spaces, Basis for a topology - The order topology - The product topology on X ×Y - The subspace topology - Closed sets and Limit points.	16 hours
Unit-II	Continuous functions - The metric topology - The metric topology (Continued)	15 hours
Unit-III	Connected spaces - Connected subspaces of the real line - Components and Local Connectedness - Compact spaces.	15 hours
Unit-IV	The Separation axioms - Normal spaces - The Urysohn lemma - The Urysohn Metrization Theorem - The Tietz Extension theorem.	16 hours
Unit-V	The Tychonoff theorem - The Stone-Cech Compactification - Metrization theorems and Para Compactness - The Nagata-Smirnov Metrization theorem - The Smirnov Metrization Theorem - Complete metric spaces.	16 hours
Text Book	Munkres J.R. (2000). *Topology*. Second Edition. Pearson Education, Inc.	
Reference Books	1. Simmons G.F. (1963). *Introduction to topology and modern analysis*. Tata Mc Graw Hill book company, INC. 2. Dugundji J. (1975). *Topology*. Prentice Hall of India. 3. John Kelly. L. (1968). *General Topology*. Van Nostrand Reinhold Company.	

	4. Stephen Willard. (1970). *General Topology*. Addision Wesley. 5. Benjamin sims. T. (1976). *Fundamentals of Topology*. Macmillan Publishing Company.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS312 **Title : FUNCTIONAL ANALYSIS**		
Hrs/ Week	6	**Credits : 4**
Objectives	On Completion of the course the students are expected i. to have a clear understanding of Normed linear spaces, Banach spaces, Hilbert spaces and ß(X,Y) ii. to understand some important, but simple to follow, theorems such as best approximation theorems, Projection theorem and Riesz Representation theorem iii. to have full grasp of the three important theorems of Functional Analysis namely Hahn-Banach Theorem, The Uniform Boundedness Principle and Closed Graph Theorem iv. to apply the concepts and results covered in the course to Numerical Analysis and Operator equations.	

Unit	**Contents**	**Hrs**
Unit-I	Norm on a Linear Space - Examples of Normed Linear Spaces - Semi norms and Quotient Spaces - Product Space and Graph Norm - Semi – Inner Product and Sesquilinear Form - Banach Spaces.	15 hours
Unit-II	Completion of Normed Linear Spaces - Some Properties of Banach Spaces - Baire Category Theorem (statement only) - Schauder Basis and Separability - Heine-Borel Theorem and Riesz Lemma - Best Approximation Theorems - Projection Theorem.	16 hours
Unit-III	Operators on Normed Linear Spaces Bounded Operators - Some Basic Results and Examples - The Space ß (X, Y)	

	Norm on ß (X,Y) - Riesz Representation Theorem - Completeness of ß (X, Y) - Bessel's Inequality - Fourier Expansion and Parseval's Formula - Riesz-Fischer Theorem	16 hours
Unit-IV	Hahn-Banach Theorem and Its Consequences - The Extension Theorem – Consequences - On Uniqueness of Extension - Separation Theorem	15 hours
Unit-V	Uniform Boundedness Principle - The Theorem and Its Consequences - Closed Graph Theorem and Its Consequences - Closed Graph Theorem - Bounded Inverse Theorem - Open Mapping Theorem - A Stability Result for Operator Equations	16 hours
Text Book	Thamban Nair, M. (2010). *Functional Analysis - A First Course.* Prentice Hall of India Pvt. Ltd. New Delhi.	
Reference Books	1. Limaye, B.V. (1981). *Functional Analysis,*Wiley Eastern, New Delhi. 2. Simmons, G.F. (1963). *Introduction to Topology and Modern Analysis.* McGraw-Hill Kogakusha. Tokyo.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS313 **Title : COMBINATORICS**		
Hrs/ Week	6	**Credits :** 4
Objectives	On completion of the course the learners are expected i. to have gained a working knowledge of the basic ideas and techniques of the subject ii. to handle various aspects of assignment problems, beginning with the famous result of Philip Hall, and on to various applications. iii. to deal with configurations iv. to have a sound knowledge of block designs and its applications to error correcting codes to understand the Steiner system S(5, 8, 24) and the construction of Leech Lattice in 24 dimensions.	

Unit	**Contents**	**Hrs**
Unit-I	Introduction to basic ideas - Selections and Binomial coefficients – Permutations - Ordered selections- Unordered selections - Further remarks on the binomial theorem and Miscellaneous	16 hours
Unit-II	**Pairings problems:** Pairings within a set - Pairings between sets - an optimal assignment problem and Gale's optimal assignment problem.	15 hours
Unit-III	**Recurrence:** Some miscellaneous problems - Fibonacci type relations - Using Generating Functions - Miscellaneous methods and Counting simple electrical networks	16 hours
Unit-IV	**The Inclusion – Exclusion Principle:** The principle, The Rook Polynomials- Steiner Systems and Sphere Packings - Introductory remarks - Steiner Systems S(5,8,24) and Leech's Lattice.	16 hours

Unit-V	**Block Designs and Error correcting codes:** Block designs - Square block designs - Hadamard configurations and Error correcting codes.	15 hours
Text Book	Ian Anderson. (1974), *A first course in combinatorial Mathematics.* Oxford University press.	
Reference Books	1. Krishnamurthy, V. (1986), *Combinatorics.*: Affiliated east west press pvt ltd. New Delhi. 2. Balakrishnan, V.K. and Balakrishnan, V. (1984), *Schaum's outline of Combinatorics.* Mcgraw hill publishers.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS314 **Title : GRAPH THEORY**		
Hrs/ Week	6	**Credits :** 4
Objectives	Graph theory is a major area of Combinatorics. In this Course we introduce the learners to some basic topics in graph theory.	
Unit	**Contents**	**Hrs**
Unit-I	**Graphs and Subgraphs:** Graphs and simple graphs - Graph Isomorphism - The Incidence and adjacency matrices – Subgraphs - Vertex degrees - path and Connection and Cycles. Trees: Trees - Cut edges and bonds - Cut vertices and Cayley's formula.	16 hours
Unit-II	**Connectivity:** Connectivity and Blocks. Euler Tours and Hamilton cycles: Euler tours and Hamilton cycles.	16 hours
Unit-III	**Matchings:** Matchings - Matchings and coverings in bipartite graphs and perfect matchings. Independent sets and Cliques: Independent sets.	16 hours
Unit-IV	**Edge Colourings:** Edge chromatic number and Vizing's theorem. Vertex Colourings: Chromatic number, Brooks' theorem, Hajo's Conjecture - Dirac's Theorem, Chromatic polynomials, Girth and chromatic number.	15 hours
Unit-V	**Planar Graphs:** Plane and planar graphs, Dual graphs - Euler's formula and Kuratowski's theorem. Directed Graphs: Directed graphs - Directed paths and directed cycles.	15 hours

Text Book	Bondy, J.A. and Murty, U.S.R. (1976), *Graph Theory with Applications*, Macmillan Company.
Reference Books	1. Balakrishnan, R. and Ranganathan, K. (2000), *A Text Book on Graph Theory*. Springer Verlog, New York. 2. Gould, R. (1988), *Graph Theory*. The Benjamin/ Cummings Publishing Company, Inc., California. 3. Hartsfield, N. and Ringel, G. (1990), *Pearls in Graph Theory*. Academic Press.

Department	Mathematics	
Course	M. Sc	**Effective From the Year :**2016
Subject code : 16PMS3E3 **Title : LATEX**		
Hrs/ Week	4	**Credits : 3**
Objectives	This course provides students with an introduction to technical writing and computer presentation with LATEX, which is the de-facto standard in computer science, mathematics and many of sciences**.**	

Unit	**Contents**	**Hrs**
Unit-I	Text formatting – TEX and its offspring - What's different in LATEX 2ε - Distinguishing LATEX 2ε - Basics of LATEX file.	11 hours
Unit-II	Commands and environments – Command names and arguments – Environments - Declarations - Lengths - Special Characters - Fragile Commands - Exercises.	11 hours
Unit-III	Document layout and Organization – Document class, Page style - Parts of the document - Table of contents -Fine – tuning text - Word division. Displayed text – Changing font - Centering and indenting, Lists - Generalized lists - Theorem like declarations, Tabulator stops - Boxes.	10 hours
Unit-IV	Tables - Printing literal text - Footnotes and marginal notes - Drawing pictures with Latex.	10 hours
Unit-V	Mathematical formulas – Mathematical environments, Main elements of math mode - Mathematical symbols- Additional elements - Fine – tuning mathematics.	10 hours

Text Book	Kopka.H and Daly P.W. (1999), *A Guide to Latex, Third Edition, Addison – Wesley, London.*
Reference Books	1. George Gratzer . (2007). *More Math into latex, Fourth Edition, Springer*. 2. www.tug.org.in/tutorials.html. *A latex primer*

Department	**Mathematics**	
Course	**M.Sc.,**	**Effective From the Year :** 2016
Subject code : 16PMS3E4 **Title : PROGRAMMING LAB IN LATEX**		
Hrs/ Week	**2**	**Credit : 2**
Objectives	This course is designed to provide a practical exposure to the students on LATEX	

List of Programs

1. To illustrate different font sizes in Latex
2. To prepare a title page in Latex document
3. To understand the section hierarchy of book environment in Latex
4. To prepare a list using itemize environment in Latex
5. To prepare a table in Latex
6. To prepare a table in Latex with multiple title row
7. To split the equations in Latex
8. To type a equations using left cases in Latex
9. To type a system of equations in Latex
10. To type a equations using right cases in Latex
11. To type a Binomial equations in Latex
12. To type a Christottol symbol in Latex
13. To use a cross reference in Latex article
14. To import '.eps' picture in Latex
15. To import a picture using Latex draw in Latex

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS415 **Title : FLUID DYNAMICS**		
Hrs/ Week	6	**Credits :** 4
Objectives	On completion of the course the students are expected i. to have a good understanding of the fundamental equation of viscous compressible fluid ii. to have studied Bernoulli equation, Momentum theorems and their various applications. iii. to understand the motion of solid bodies in fluid iv. to have a sound knowledge of boundary layer theory.	

Unit	**Contents**	**Hrs**
Unit-I	**Kinematics of fluids and Fundamental equations of the flow of viscous compressible fluids:** Methods of describing fluid motion: Lagrangian method, Eulerian method-Translation, Rotation and Rate of deformation- Streamlines, Path lines and Streak lines- Material derivative and acceleration- Vorticity, Vorticity in Polar – coordinates- Vorticity in orthogonal curvilinear coordinates- The equation of continuity - Conservation of mass- Equation of motion - conservation of momentum- The energy equation - conservation of energy.	16 hours
Unit-II	**One dimensional invisid incompressible flow and two and three dimensional invisid incompressible flow:** Equation of continuity Stream tube flow- Equation of motion Euler's equation-The Bernoulli's equation- Applications of the Bernoulli equation((a) & (b)) - The Momentum theorem- Applications of the momentum theorem((a) & (b))- Equation of continuity - Eulerian equation of motion- Circulation theorems- Velocity potential - irrotational flow- Integration of the equations of motion - Bernoulli's equation- The momentum	

	theorem- The moment of momentum theorem.	16 hours
Unit-III	**Laplace's equation:** Laplace equation in Cartesian coordinates-Laplace equation in cylindrical coordinates – Laplace equation in Spherical coordinates(derivations omitted) -Stream function in 2 dimensional motion- The Flow net - Two dimensional flow examples- Stream function in three dimensional motion – Three dimensional axially symmetric flow examples	15 hours
Unit-IV	**Motion of solid bodies in a Fluid:** Rankine's method of constructing streamlines- Superposition of source and rectilinear flow- Superposition of source and sink with rectilinear flow – The Rankine body- Superposition of rectilinear flow and doublet- Superposition of Vortex, Rectilinear flow and doublet in a two dimensional case.	15 hours
Unit-V	**Laminar flow of viscous incompressible fluids and Boundary Layer Theory:** Flow between parallel flat plates- Steady flow in pipes, Flow between two co-axial cylinders- Flow between two concentric rotating cylinders - Boundary layer concept- The boundary layer equations in two dimensional flows- The boundary layer along a flat plate- The Blasius solution.	16 hours
Text Book	Yuan, S.W. (1988), *Foundations of fluid mechanics.* Prentice Hall of India Pvt. Ltd.	
Reference Books	1. Shanthi Swarup(2000), *Fluid dynamics*, Krishna Prakasan media Pvt. Ltd., Meerut, 2. Frank Chorlton (2004), *Text book on Fluid Dynamics*, CBS Publishers and Distributors, Delhi. .	

CONTENTS:

Department	Mathematics	
Course	M.Sc	**Effective From the Year :**2016
Subject code : 16PMS416 **Title : OPERATOR THEORY**		
Hrs/ Week	6	**Credits :** 4
Objectives	On completion of the course the students are expected (i) To understand the concepts of Dual space, Reflexivity, Weak convergence and Compact operators and to illustrate them with examples. (ii) To have a clear understanding of Spectrum, Resolvent set of an operator and Spectral mapping theorem (iii) To have well founded knowledge in adjoint of an operators, self adjoint operators, normal operators, unitary operators and their properties.	
Unit	**Contents**	**Hrs**
Unit-I	Dual Space Considerations -Representation of Dual Spaces - Dual of $l^p(n)$ - Duals of Some Sequence Spaces - Duals of C[a,b] and L^p[a,b] - Separability Revisited	16 hours
Unit-II	Reflexivity and Weak Convergence – Reflexivity - Weak Convergence - Best Approximation in Reflexive Spaces	15 hours
Unit-III	Compact Operators - Some Characterizations - Space of Compact Operators - Further Properties	15 hours
Unit-IV	Spectral Results for Banach Space Operators - Eigenspectrum and Approximate Eigenspectrum - Spectrum and Resolvent Set - Spectral Radius - Spectral Mapping Theorem - Gelfand-Mazur theorem and Spectral radius formula (In 10.2.3, Theorem 10.17 only)	16 hours
Unit-V	Operators on Hilbert Spaces - Adjoint of an Operator - Compactness of the Adjoint Operator - Sesquilinear Functionals - Self-Adjoint, Normal and Unitary Operators - Numerical Range and Numerical Radius - Some Characterizations	16 hours
Text Book	Thamban Nair, M. (2010), *Functional Analysis - A First Course.* Prentice Hall of India Pvt. Ltd. New Delhi.	

Reference Books	1. Simmons, G.F. (1963). *Introduction to Topology and Modern Analysis.* McGraw-Hill Kogakusha, Tokyo. 2. Sunder, V.S. (1997). *Functional Analysis: Spectral Theory*. Hindustan Book Agency, New Delhi. 3. Taylor, A.E. and Lay, D.C. (1980). *Introduction to Functional Analysis.* Second Edition. Wiley, New York.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS417 **Title : CONTROL THEORY**		
Hrs/ Week	6	**Credits :** 4
Objectives	Control theory is relatively a young branch of Applied Mathematics. On completion of the course the students are expected to develop their knowledge in the basic problems, namely, observability, controllability, stability, stabilizability and optimal control.	
Unit	**Contents**	**Hrs**
Unit-I	**Observability:** Linear Systems - Observability Grammian - Constant coefficient systems - Reconstruction kernel and Nonlinear Systems.	16 hours
Unit-II	**Controllability:** Linear Systems - Controllability Grammian, Adjoint Systems - Constant coefficient systems - Steering function and Controllability of Nonlinear System.	15 hours
Unit-III	**Stability:** Stability - Uniform Stability and Asymptotic Stability of Linear Systems - Perturbed linear systems and Nonlinear systems.	15 hours
Unit-IV	**Stabilizability:** Stabilization via linear feedback control, Bass method - The Controllable subspace and Stabilization with restricted feedback.	16 hours
Unit-V	**Optimal Control:** Linear time varying systems with quadratic performance criteria - Linear time invariant systems and nonlinear systems.	16 hours
Text Book	Balachandran, K. and Dauer, J.P. (2012). *Elements of Control Theory*.: Narosa, New Delhi.	

Reference Books	1. Conti, R. (1976). *Linear Differential Equations and Control.* Academic Press, London. 2. Curtain, R.F. and Pitchard, A.J. (1977). *Functional Analysis and Modern Applied Mathematics*. Academic Press, New York. 3. Klamka, J. (1991). *Controllability of Dynamical Systems*. Klumer Academic Publisher, Dordrecht.

Contents:

For Unit I **:** Chapter2 : Sections 2.1 & 2.2
For Unit II **:** Chapter3 : Sections 3.1 & 3.2
For Unit III **:** Chapter4 : Sections 4.1, 4.2& 4.3
For Unit IV **:** Chapter5 : Sections 5.1, 5.2 & 5.3
For Unit V **:** Chapter6 : Sections 6.1, 6.2 & 6.3.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2016
Subject code : 16PMS4E5 **Title : STOCHASTIC DIFFERENTIAL EQUATIONS**		
Hrs/ Week	6	**Credits :** 5
Objectives	Stochastic differential equation have a wide range of applications inside as well as outside mathematics and the subject has a rapidly developing life of its own as a fascinating research field with many interesting unanswered questions. The course needs some background in measure theory. In this paper six problems are introduced where stochastic differential equations play an essential role in finding their solutions, which will motivate the students for the further advance studies in this and related branches of mathematics.	
Unit	**Contents**	**Hrs**
Unit-I	**Introduction:** Stochastic Analogs of Classical Differential Equations, Filtering Problems - Stochastic Approach to Deterministic Boundary Value Problems - Optimal Stopping, Stochastic Control and Mathematical Finance. **Some Mathematical Preliminaries:** Probability Spaces - Random Variables and Stochastic Processes and an Important Example: Brownian motion.	16 hours
Unit-II	**Ito Integrals:** Construction of the Ito Integral - Some Properties of the Ito Integral and Extensions of the Ito Integral.	15 hours
Unit-III	**The Ito Formula and The Martingale Representation Theorem:** The 1-dimensional Ito Formula- the Multi-dimensional Ito Formula and the Martingale Representation Theorem **Stochastic Differential Equations:** Examples and Some Solution Methods - An Existence and Uniqueness Result and Weak and Strong Solutions.	16 hours

Unit-IV	**The Filtering Problem:** Introduction - The 1-dimensional Linear Filtering Problem and the Multidimensional Linear Filtering Problem.	15 hours
Unit-V	**Diffusions: Basic Properties:** The Markov Property, the Strong Markov Property, the Generator of Ito Diffusion, the Dynkin Formula, and the Characteristic Operator.	16 hours
Text Book	Bernt Oksendal. (2014), *Stochastic Differential Equations – An Introduction with Applications.* Sixth Edition. Springer-Verlog, Heidelberg.	
Reference Book	J. Medhi. (2009). *Stochastic Processes.* Third Edition. New Age International(p) ltd.	